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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/597,366	07/21/2006	Masakazu Hirose	40858	9931

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EXAMINER	
HOBAN, MATTHEW E	
ART UNIT	PAPER NUMBER
1793	
MAIL DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/597,366	HIROSE ET AL.	
	Examiner	Art Unit	
	Matthew E. Hoban	1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 July 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *See Continuation Sheet*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Continuation of Attachment(s) 3). Information Disclosure Statement(s) (PTO/SB/08), Paper No(s)/Mail Date :7/21/2006 3/31/2007 .

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1-8, 11-12, and 14-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ise in his publication entitled "High Power Characteristics of

Piezoelectric Ceramics in $Pb(Mn_{1/3}Nb_{2/3})O_3$-$PbTiO_3$-$PbZrO_3$ System" in view of Tajimi in his publication entitled "Electric-Field induced Crack Growth Behavior in PZT/Al_2O_3 Composites."

Regarding Claim 1: Ise teaches a range of compositions seen in Figure 4, where in this figure, the amount of PMnNO ($Pb(Mn_{1/3}Nb_{2/3})O_3$) is plotted separately as a function of PZO (PbZrO3) content. The balance of the composition is PTO ($PbTiO_3$). All components in the composition have the ABO3 structure and are perovskite in nature.

Ise does not teach the use of an Al-containing phase in his composition.

However, Tajimi teaches that the addition of .5-1 vol% Al_2O_3 is beneficial to PZT ceramics. The addition of this secondary phase reduces the stress concentrations in the ceramic and thus inhibits microcrack coalescence and the removal of PZT grains from the ceramic body. Tajimi noted better results at 1 vol% compared to .05 vol%. In his conclusion, Tajimi notes that piezoelectric and mechanical properties are not inhibited by this addition, but the fatigue and durability of the composite is greatly increased. Therefore, one of ordinary skill in the art would see the teachings of Tajimi as highly beneficial and supplementary to those of Ise, and would be motivated to include the Al_2O_3 taught by Tajimi based on the improved properties achieved by this addition. Furthermore, Tajimi and Ise are highly combinable in that they both deal with PZT ($Pb(Zr,Ti)O_3$) piezoelectric compositions .

Regarding Claim 2: Figure 4 and the entirety of the disclosure of Ise include PMnNO.

Regarding Claim 3: In figure 4, Ise shows many compositions falling within the claim. For example the first composition in the series containing 7.5% PMnNO has roughly a value of .4 for Z, .525 for y, .075 for x, and 1 for alpha.

Regarding Claim 4: Tajimi teaches the addition of Al_2O_3.

Regarding Claim 5: Ise teaches a powder consolidation method and thus the sample is polycrystalline in nature. Tajimi teaches at page 652 that Al_2O_3 particles are incorporated both within the grains and along the grain boundaries.

Regarding Claim 6: Ise teaches the inclusion of .5 and 1 vol%. Based on the approximation that the density of PZT is roughly two times that of alumina, this results in from ~.25-.5 wt% of alumina in the composition.

Regarding Claim 7: Tajimi does not test these properties in his disclosure; however, the composition of ise in view of Tajimi would inherantly have these properties as it is of the same composition as that which is claimed. A composition of the same

components and morphology cannot have mutually exclusive properties. See MPEP 2112.

Regarding Claim 8: In figure 4, Ise shows many compositions falling within the claim. For example the first composition in the series containing 7.5% PMnNO has roughly a value of .4 for Z, .525 for y, .075 for x, and 1 for alpha. The first composition in the 10% PMnNO series has roughly a value of .35 for z, .55 for y, .1 for x, and 1 for alpha.

Ise does not teach the use of an Al-containing phase in his composition.

However, Tajimi teaches that the addition of .5-1 vol% (~.25-.5 wt%) Al2O3 is beneficial to PZT ceramics. The addition of this secondary phase reduces the stress concentrations in the ceramic and thus inhibits microcrack coalescence and the removal of PZT grains from the ceramic body. Tajimi noted better results at 1 vol% compared to .05 vol%. In his conclusion, Tajimi notes that piezoelectric and mechanical properties are not inhibited by this addition, but the fatigue and durability of the composite is greatly increased. Therefore, one of ordinary skill in the art would see the teachings of Tajimi as highly beneficial and supplementary to those of Ise, and would be motivated to include the Al2O3 taught by Tajimi based on the improved properties achieved by this addition. Furthermore, Tajimi and Ise are highly combinable in that they both deal with PZT (Pb(Zr,Ti)O3) piezoelectric compositions .

Regarding Claim 11-12: Tajimi teaches the inclusion of .5 and 1 vol%. Based on the approximation that the density of PZT is roughly two times that of alumina, this results in from ~.25-.5 wt% of alumina in the composition.

Regarding Claim 14: Ise does not report the Qmax of the compositions within the range of the claims as seen in Figure 4 (Only Material C is tested, which is ~50% PZO). Nor does he report F(-40) F(85) or the rate of change of k15. However, those compositions claimed and those of Ise in view of Tajimi, would necessarily have the same properties as seen in the claims. A composition of the same components and morphology cannot have mutually exclusive properties. See MPEP 2112.

Regarding Claim 15: Ise teaches a range of compositions seen in Figure 4, where in this figure, the amount of PMnNO ($Pb(Mn_{1/3}Nb_{2/3})O_3$) is plotted separately as a function of PZO (PbZrO3) content. The balance of the composition is PTO ($PbTiO_3$). All components in the composition have the ABO_3 structure and are perovskite in nature. Thus the composition is mainly Pb, Zr, Ti, Mn, and Nb.

Ise does not teach the use of an Al-containing phase in his composition.

However, Tajimi teaches that the addition of .5-1 vol% Al2O3 is beneficial to PZT ceramics. The addition of this secondary phase reduces the stress concentrations in the ceramic and thus inhibits microcrack coalescence and the removal of PZT grains

from the ceramic body. Tajimi noted better results at 1 vol% compared to .05 vol%. In his conclusion, Tajimi notes that piezoelectric and mechanical properties are not inhibited by this addition, but the fatigue and durability of the composite is greatly increased. Therefore, one of ordinary skill in the art would see the teachings of Tajimi as highly beneficial and supplementary to those of Ise, and would be motivated to include the Al2O3 taught by Tajimi based on the improved properties achieved by this addition. Furthermore, Tajimi and Ise are highly combinable in that they both deal with PZT (Pb(Zr,Ti)O3) piezoelectric compositions .

Ise does not report the Qmax of the compositions within the range of the claims as seen in Figure 4 (Only Material C is tested, which is ~50% PZO). Nor does he report F(-40) F(85) or the rate of change of k15. However, those compositions claimed and those of Ise in view of Tajimi, would necessarily have the same properties as seen in the claims. A composition of the same components and morphology cannot have mutually exclusive properties. See MPEP 2112.

Regarding Claim 16: Tajimi teaches the use of Al_2O_3 as an additive.

5. Claim 9-10 and 17 rejected under 35 U.S.C. 103(a) as being unpatentable over Ise in view of Tajimi as applied to claim 8 and 15 above, and further in view of Hammer in her publication entitled "Correlation between surface texture and chemical composition of undoped, hard, and soft, piezoelectric PZT ceramics".

Please review the previous rejection based on Ise in view of Tajimi. In brief Ise teaches a composition in the 10% PMnNO series has roughly a value of .35 for z, .55 for y, .1 for x, and 1 for alpha. Tajimi teaches the addition of roughly about .25-.5 wt% alumina to this composition.

Ise and Tajimi report their compositions based on stoichiometry and report the value of alpha as exactly 1.

However, Hammer teaches that one expects lead and oxygen vacancies in undoped PZT compositions based on thermodynamics. Due to this, the value of alpha is going to be slightly less than the stoichiometric value based on the temperature. At anything above absolute zero, the value of alpha is below 1 based on this fact. Sintering is performed on these compositions so the value of alpha is most decidedly slightly less than 1, meaning in the ppm range of values. Although Hammer is directed towards undoped PZT, where Ise uses PMnNO dopants, the thermodynamic behavior of lead vacancies are seen as highly relevent. Although, Ise includes dopants, his compositions remains as physical matter and is subject to the laws of thermodynamics.

6. Claim 13 rejected under 35 U.S.C. 103(a) as being unpatentable over Ise in view of Tajimi as applied to claim 8 above, and further in view of Yoshizawa in 6299791.

Please review the previous rejection based on Ise in view of Tajimi. In brief Ise teaches a composition in the 10% PMnNO series has roughly a value of .35 for z, .55 for y, .1 for x, and 1 for alpha. Tajimi teaches the addition of roughly about .25-.5 wt% alumina to this composition.

Tajimi in view of Ise includes only al2o3 as an additive.

However, Yoshizawa teaches at Column 3, Lines 13-22 that the addition of from .003-.1 wt% SiO2 is beneficial in further increasing the mechanical strength of the composite piezoelectric material so that it can undergo machining without suffering from damage. One of ordinary skill in the art would see the benefit of the combination of these teaching as the inclusion of SiO2 in the composition has been shown to create a better more resilient product. Furthermore, the art of reference is highly combinable in that Yoshizawa also teaches the inclusion of alumina, and the teachings are based on a piezoelectric which is a combination of PTO, PZO, and PMnNO.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew E. Hoban whose telephone number is (571) 270-3585. The examiner can normally be reached on Monday - Friday from 7:30 AM to 5 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jerry Lorengo can be reached on (571) 272-1233. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/J.A. LORENGO/
Supervisory Patent Examiner, Art Unit 1793

meh